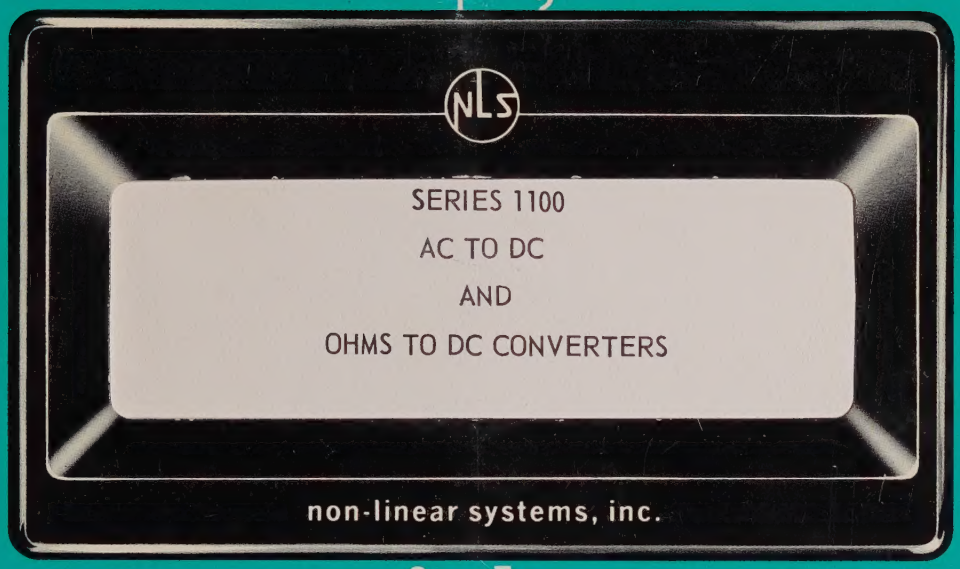

M13768X

non linear systems, inc.

DEL MAR, CALIFORNIA

DOCUMENT NO. 573
June, 1964

SERIES 1100
AC TO DC
AND
OHMS TO DC CONVERTERS

Originator of the Digital Voltmeter
non-linear systems, inc.
DEL MAR, CALIFORNIA

First Printing 300 July 1964

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PRINTED IN THE UNITED STATES OF AMERICA

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Non-Linear Systems, Inc., warrants each instrument of its manufacture to be free from defects in material and workmanship. Our obligation under this Warranty is limited to servicing any instrument returned prepaid to our factory for that purpose within one year of delivery to the original purchaser. Serviced instruments are returned F. O. B. Del Mar, Calif. Tubes, semiconductors, choppers, and lamp bulbs are exempted from this Warranty. Non-oil bath stepping switches are warranted for ninety days.

Instruments returned to the factory are accepted only when prior authorization has been given by an authorized representative or Non-Linear Systems, Inc.

Non-Linear Systems, Inc., reserves the right to make changes in design at any time without incurring any obligation to install same on units previously purchased.

No warranty issuing from any source other than Non-Linear Systems, Inc., is valid.

- All prices are quoted F. O. B. destination, U. S. A.
- Terms—½% 10 days, net 30 days.
- Specifications and prices subject to change without notice.

The 1100 Series Input Converters are designed to accept AC, ohms, and ratio inputs, convert these into DC signals which bear a linear relationship to the input, and feed this DC intelligence into an associated digital voltmeter. Virtually any measuring task can be met by using the appropriate digital voltmeter - converter combination.

The 1100 Series Converters are supplied in two basic forms:

1. The 1100 Models, numbered 1101 through 1110, are supplied as complete, self-powered units, each with its own case and panel for mounting into a 19" rack. Specific capabilities of these models are here listed:

	ALLOWS MEASUREMENT OF (with appropriate DVM)							
MODEL	VOLTS DC	VOLTS AC	OHMS	DC/DC RATIO	AC/AC RATIO	AC/DC DC/AC RATIO	OHMS/OHMS RATIO	RANGING
1101	YES	YES	YES	-	-	-	-	MANUAL
1102	YES	YES	YES	-	-	-	-	AUTO
1103	YES	YES	YES	YES	YES	YES	-	MANUAL
1104	YES	YES	YES	YES	YES	YES	-	AUTO
1105	YES	YES	YES	YES	YES	YES	YES	MANUAL
1106	YES	YES	YES	YES	YES	YES	YES	AUTO
1107	YES	-	YES	YES	-	-	YES	MANUAL
1108	YES	-	YES	YES	-	-	YES	AUTO
1109	YES	YES	-	-	-	-	-	MANUAL
1110	YES	YES	-	-	-	-	-	AUTO

2. Other 1100-type converters are specifically designed to work within the associated digital voltmeter housing. Digital voltmeters so equipped are listed:

MODEL	VOLTS AC	OHMS	AC & RANGING
3303	-	YES	MANUAL
3305	YES	-	MANUAL
3306	-	YES	MANUAL
3307	YES	YES	MANUAL
3316	YES	-	MANUAL
3317	YES	-	MANUAL
3318	-	YES	MANUAL
3319	-	YES	MANUAL
3320	YES	YES	MANUAL
3326	YES	-	MANUAL
3327	YES	-	MANUAL
3328	-	YES	MANUAL
3329	-	YES	MANUAL
3330	YES	YES	MANUAL
3333	YES	-	MANUAL

MODEL	VOLTS AC	OHMS	AC & RANGING
3339	YES	-	MANUAL
3340	YES	-	MANUAL
3342	YES	YES	AUTO
3344	YES	YES	AUTO
3346	YES	YES	AUTO
3347	YES	-	MANUAL
3348	YES	-	AUTO
4922	YES	-	MANUAL
4923	-	YES	MANUAL
4924	YES	YES	MANUAL
4927	YES	-	MANUAL
4928	-	YES	MANUAL
4929	YES	YES	MANUAL
4930	YES	-	MANUAL

A fuller statement of the capabilities of these combination DVM-converter models is given in the individual digital voltmeter manual. These built-in converters are not available as separate units because they are custom-fitted to the specific digital voltmeter model. For example, in certain models the front-panel controls are part of the converter mechanism and, secondly, operating power may be derived from both the digital voltmeter and the converter. Despite individual model differences, the conversion circuits are of the same general sort used with the separately-packaged converters, Models 1101 through 1110. Most of the essential differences are in the control circuits, the input and output connections, and in the electronic packaging design.

The information given in this manual takes into account these differences; schematic drawings make clear the similarities and dissimilarities. For the most part, the calibration procedure is the same for all models and will vary only in physical location of adjustment and in accord with the specific measuring capability of each model. Figures 4-1 and 4-2 in this manual serve to identify various typical designs and to locate adjustment points.

For added information, please contact the nearest NLS Service Center. Addresses are given at the end of this section.

NLS ENGINEERING/SERVICE CENTERS

Alabama, Huntsville
2907 Governors Drive, Suite A
205-534-1077

Arizona, Phoenix
2802 E. Shangri-La
602-274-7008

California, San Jose 95128
2858 Stevens Creek Blvd.
408-241-0200

California, So. Pasadena 91030
1015 Fremont
213-682-3705

California, Solvang
2681 Baseline
Santa Ynez 5272

Florida, Orlando
705 W. Colonial Drive
305-423-8901

Illinois, Chicago 60635
1915 N. Harlem Ave.
312-889-1277

Massachusetts, Waltham
235 Bear Hill Rd.
617-899-1430

Michigan, Detroit 48240
26847 Grand River Ave.
313-531-1403

Minnesota, St. Paul 55104
1821 University Ave.
612-644-0585

Missouri, Florissant
100 St. Francois St.
314-921-7666

New Jersey, Caldwell 07007
387 Passaic Ave.
201-228-2525

New Jersey, Cherry Hill 08034
1500 Kings Hwy.
609-428-1663

New Mexico, Albuquerque
505-265-4887

New York, Jericho
50 Jericho Turnpike
516-333-7020

New York, Poughkeepsie
21 Davis Ave.
914-471-0850

New York, Rochester, 14607
75 College Ave.
716-244-0720

Ohio, Dayton
3300 S. Dixie Drive
513-298-8138

Pennsylvania, Pittsburgh 15325
201 Penn Center Bldg., Suite 301F
412-824-1800

Texas, Dallas 75235
8428 Kate St., Suite 206
214-363-5533

Texas, Houston
P. O. Box 35007
713-668-1845

Virginia, Arlington 22201
10008 N. Randolph St.
703-524-4732

Washington, Bellevue
208 Carlson Bldg.
206-454-9332

EXPORT:

Frazar & Hansen, Ltd.
150 California St.
San Francisco, California
415-981-5262

TWX at:

Jericho, New York 516-333-8548
Dallas, Texas 214-899-8051
Del Mar, Calif. 714-277-3191

RANGES: 9.999/99.99/999.9 volts ac, 50 cps - 10 kc; 9.999/99.99/999.9 kilohms.

CONVERTER OUTPUT: 10 volts dc for full scale ac or ohms input on each range. Approx. 10 milliohms output resistance.

RATIO MEASUREMENTS: Models measuring ac-to-ac or ohms-to-ohms ratio have two internal converters; one supplies the input and the other the reference signal to the associated dc digital ratiometer. Thereby, full scale ac to ac and ohms to ohms ratios are 1:1, 10:1 and 100:1.

RANGE CHANGING: Automatic (by logic within converter) or manual, depending upon model. Lamps indicate range in use.

ACCURACY OF CONVERSION: ± (0.05% of reading +0.05% of range in use) for ac; ±(0.01% of reading ±0.01% of range in use) for ohms. AC measurements are based upon average value of waveform; calibration is in terms of RMS value of a pure sine wave.

AC INPUT IMPEDANCE: 1 megohm shunted by 100 pf for ac input or ac ratio reference voltages.

CURRENT THROUGH TEST RESISTANCE: 1000/100/10 ua on the 9.999/99.99.999.9 kilohm ranges, respectively.

SETTLING TIME: 2 sec. avg. for ac inputs for 0.1% accuracy (output rises to 0.01% of final value in 8 sec., to reach 0.1%). Settling time is proportional to resistance on ohms measurement, settling to 0.01% of final value in 2 sec., max., for 1 meg.

GROUND ISOLATION: Input ground is connected to dvm ground but is not to converter chassis.

DIMENSIONS: (1100 Series) 5 1/4" high, 15 1/4" deep, 19" wide.

PRIMARY POWER: 115 v., 60 cps., 25 watts, max.

COMPATIBILITY: The input converter is completely self-contained and independent of any power or control signals from the digital voltmeter. It can be used with any dvm having a 10 vdc input range and input resistance of greater than 5 K ohms. Similarly, it can be used to drive external reference inputs of these same dvms for ac ratio measurement.

Because the output noise of the 1100 Series exceeds 0.001% of full scale (10 volts), they may produce "jitter" in the rightmost digit of 5 digit dvms, which have 0.001% resolution. Therefore, consult NLS before ordering one for a 5-digit dvm. However, in any 5 digit AC-DC dvm models which NLS specifies as having an 1100 Series Converter, NLS incorporates circuitry to reduce ac resolution of the dvm system to 0.01% of full scale (4 digits). This practice is philosophically sound since Series 1100 ac conversion accuracy is relatively far from 0.001%. If 0.001% resolution in ac measurement is required, use the NLS Series 1300 AC to DC Converters, which are the only ones available with 0.001% resolution from any manufacturer at time of publication.

NOTE: Specifications are subject to change without notice.

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UNPACKAGING

The 1100 Series Converter is shipped in a single container and is shock-supported by fitted top and bottom sections of molded polystryene construction. The two halves are connected by adhesive fiberglass strips which should be cut to make the instrument accessible for removal. Prybars and other tools should not be used to open the shipping container. No preservatives are used in this package and the instrument is shipped fully assembled. There is no packing material inside the instrument. Other converter assemblies which are supplied as an integral part of an associated digital voltmeter are similiarly packaged.

INSPECTION

When the converter is lifted from its packing material, it should be checked for signs of visible damage. Verify also that the identification plate carries the same serial number as appears on the invoice or packing slip.

PREPARATION FOR STORAGE

Except for the removal of cables, no special procedures are required to prepare the instrument for storage. It is recommended that the instrument be returned to its shipping container if it is to be stored. The storage area should be free of excessively high humidity and temperature extremes. If storage is in an environment in which mildew or corrosion can occur, periodic inspections should be made and, if necessary, protective measures taken to prevent deterioration.

ENVIRONMENTAL REQUIREMENTS

For satisfactory results, the instrument should be operated at an ambient temperature of 0 to 40 degrees Centigrade (32 to 104 degrees Fahrenheit) and at a barometric pressure of 0.8 to 1.1 Atmospheres.

OPERATION

Figure 3-1, and A and B, shows the front-panel control arrangements of the 1100 Models. Since the controls are self-explanatory, a detailed description of their functions is not necessary. Models 1103 through 1108 contain reference converters which are very similiar to the signal converter assemblies used. In each of these instruments the controls at the left (except for the POWER switch) are used to set the reference converter portion; the controls at the right are for the converter. Additionally, Models 1102, 1104, 1106, 1108, and 1110 are equipped with an automatic range function. When the range switch is set at AUTO on these models, indicator lights on the front panel indicate which range is in use.

READING THE DISPLAY

Since the 1100 Series Converters produce a DC output up to 10 volts, the associated digital voltmeter should be locked in the 10-volt range for all readings. This means that the decimal point on the display is to be disregarded. For example, if an input to the converter is 125.4 volts AC, the converter output will be 1.254 volts DC and the associated digital voltmeter will read 1.254. Therefore the correct position for the decimal point must be interpreted by checking the range switch position on the converter, or by noting which indicator light is illuminated on automatic ranging converters.

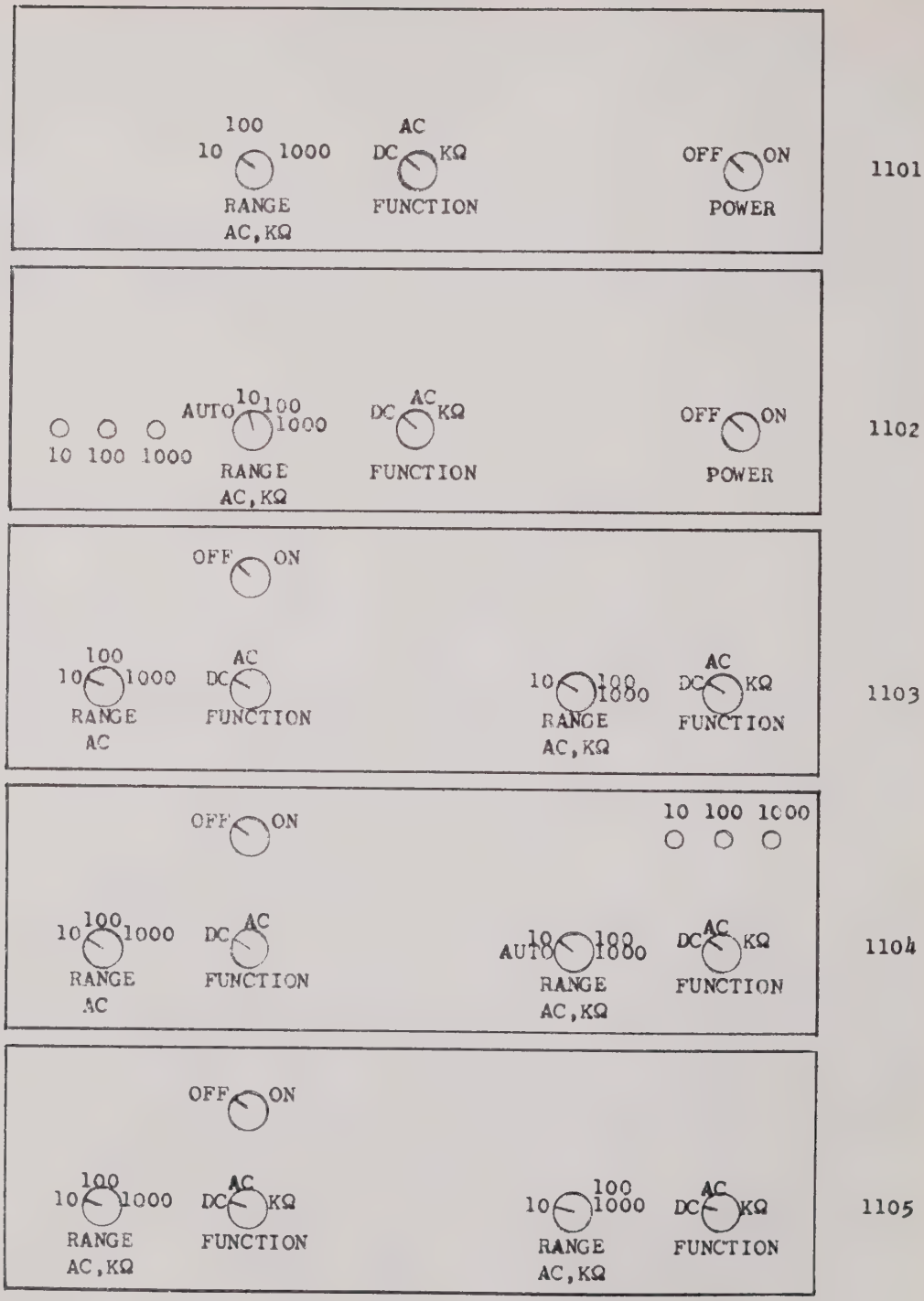


Figure 3-1A. Front-panel controls of 1100 Models. Instruments having two FUNCTION and RANGE controls contain two signal converter assemblies; the left-hand controls (except POWER switch) are for the reference converter.

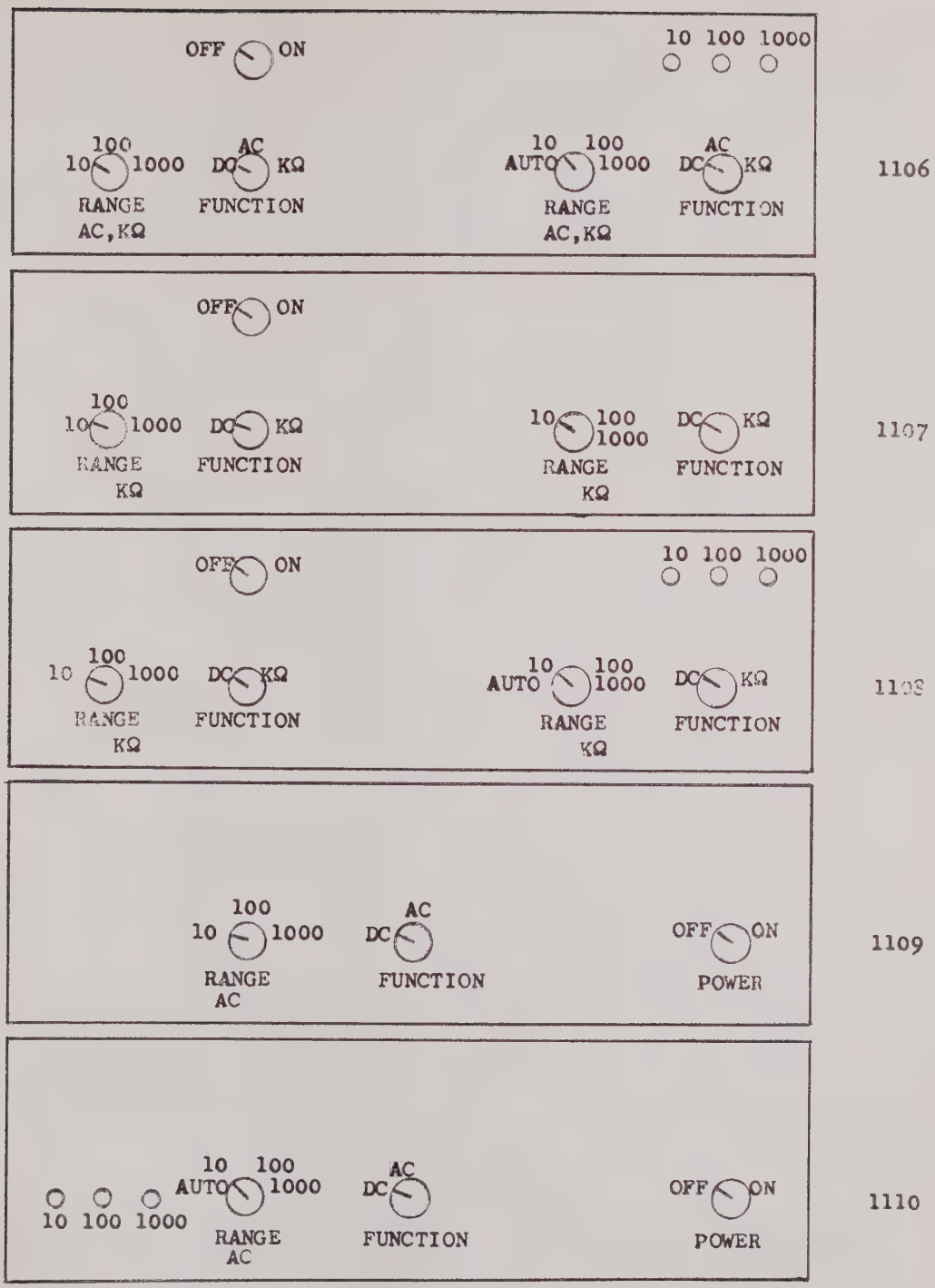


Figure 3-1B. Front-panel controls of 1100 Models. Instruments having two FUNCTION and RANGE controls contain two signal converter assemblies; the left-hand controls (except POWER switch) are for the reference converter.

1100 SERIES CONVERTERS AND CONVERTER ASSEMBLIES INSTALLED IN 4900 AND 3300 SERIES DIGITAL VOLTMETERS.

1100 Series Input Converters, Models 1101 through 1112, and 4900 Series Digital Voltmeters listed on Page 1, use the same basic signal converter assembly. It is on this assembly that all calibration adjustments are made.

Figure 4-1 shows such a converter. Figure 4-2 shows a converter installed in the 3300 Series Digital Voltmeter. In the charted calibration procedure given in this section, these drawings should be consulted to identify all adjustment points.

If the converter has an auto range capability, additional adjustments are required. These adjustments are described on Page . In addition, those models which contain two signal converter assemblies will require that each converter be calibrated separately, but against the same standards. Figure 4-3 shows the assembly layouts for 1100 Series Converters.

Before an attempt is made to calibrate the converter, steps should be taken to assure that it is in good working order and that the associated 5-digital voltmeter is in correct calibration. The following seven steps will provide an adequate initial check of the converter:

STEP 1. Allow a 45-minute warmup of both the converter and the digital voltmeter.

STEP 2. Connect the output of the converter to the 5-digit voltmeter.

STEP 3. Set the voltmeter at the 1000-volt range (or at AUTO with models so equipped) and set the function controls on the meter and converter to AC (or on those converters which do not make AC measurements, set the converter function control to OHMS).

STEP 4. Short the converter input leads.

STEP 5. Adjust potentiometer R-30 (location shown in Figures 4-1 and 4-2) so that the associated digital voltmeter reads all zeroes.

STEP 6. If this adjustment allows a full display of zeroes, the converter is ready for calibration; if R-30 cannot be adjusted to bring the reading to an all-zero display, then maintenance is required. See the Maintenance Section and follow instructions given in the Initial Checks and Adjustments Chart.

STEP 7. When the converter is known to be functioning properly, proceed with the AC Calibration Chart.

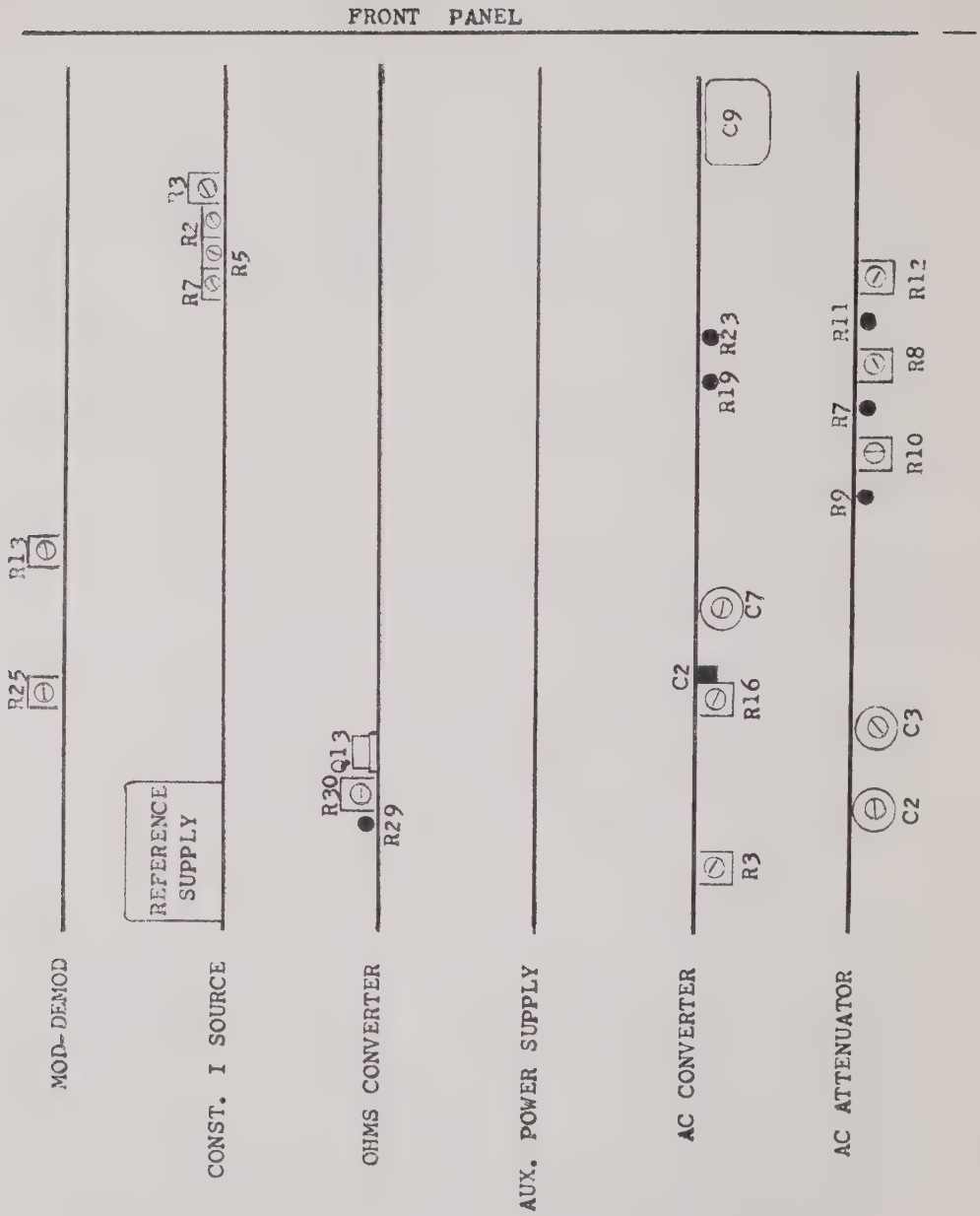


Figure 4-1. Top View of Signal Converter Assemblies used in Models 1101 through 1110. Test Point and Adjustment Locations are shown. Not all adjustments are present on all models.

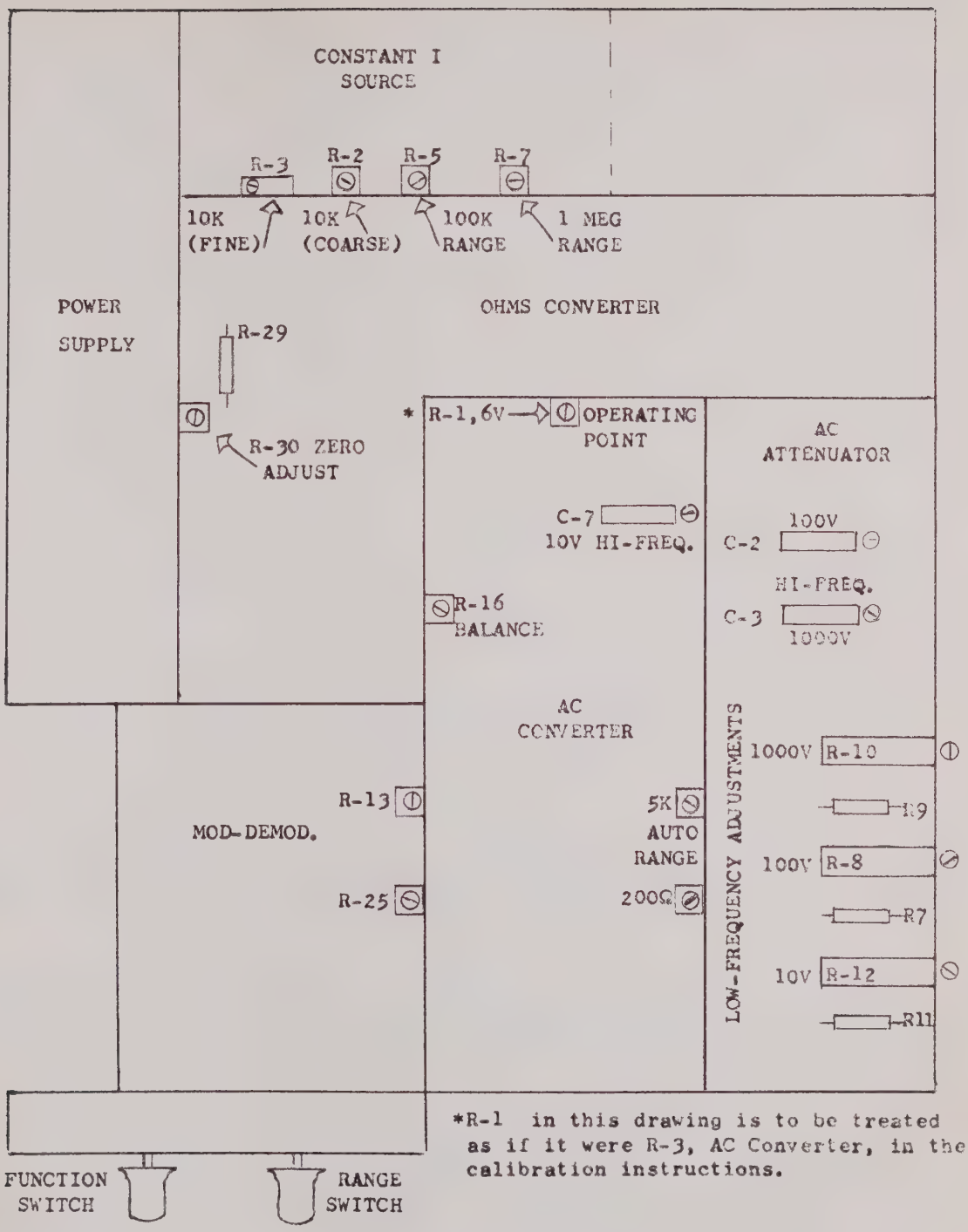
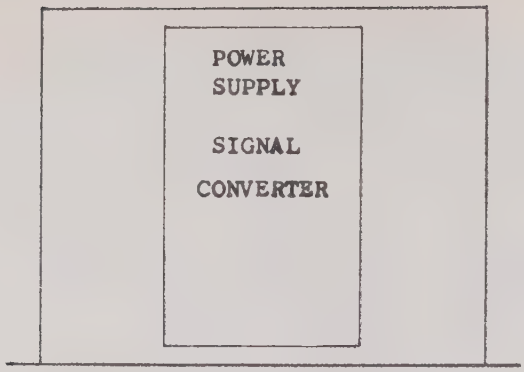
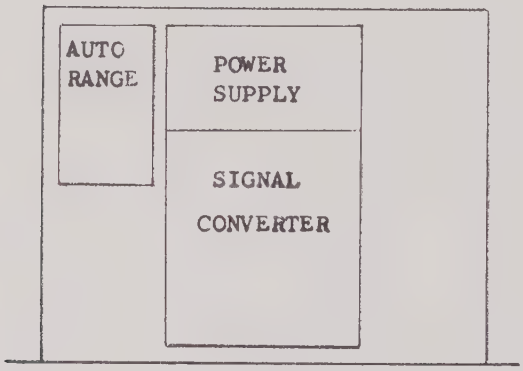


Figure 4-2. Front, Bottom View of Signal Converter Assembly used in converters supplied with 3300 Series Digital Voltmeters. Not all adjustments shown are present on all models.



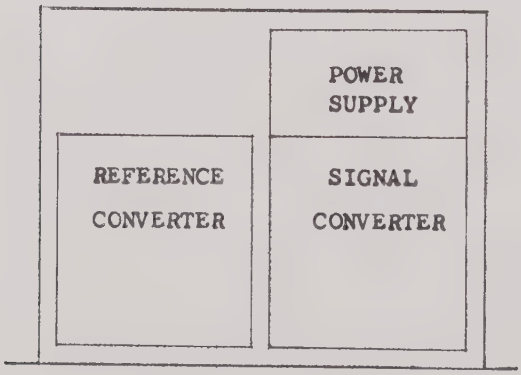
MODELS

1101
1109



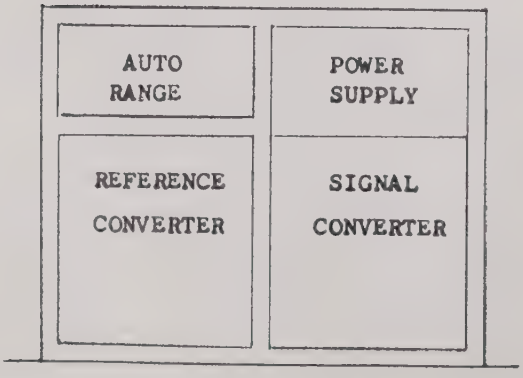
MODELS

1102
1110
1112



MODELS

1103
1105
1107

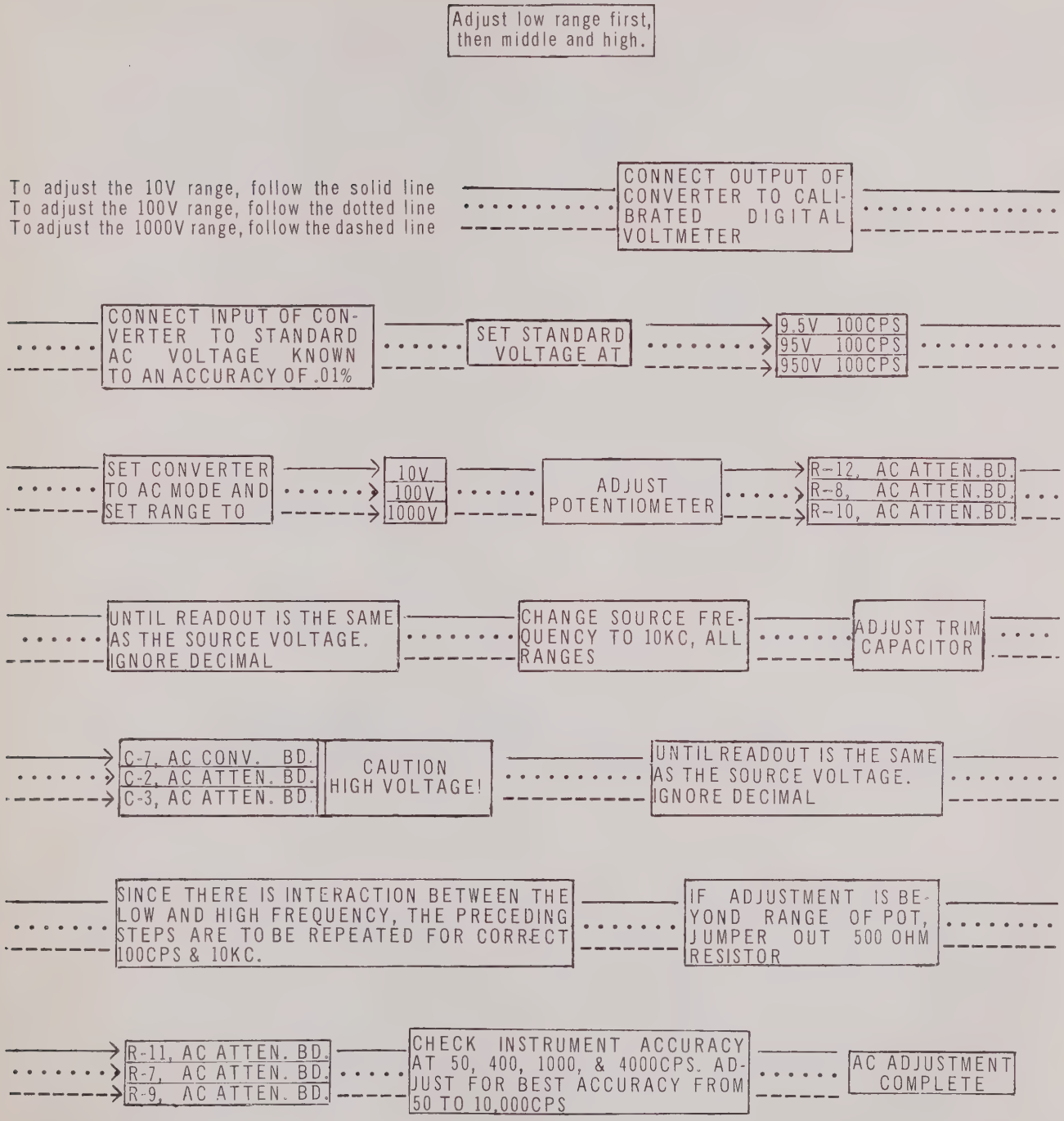


MODELS

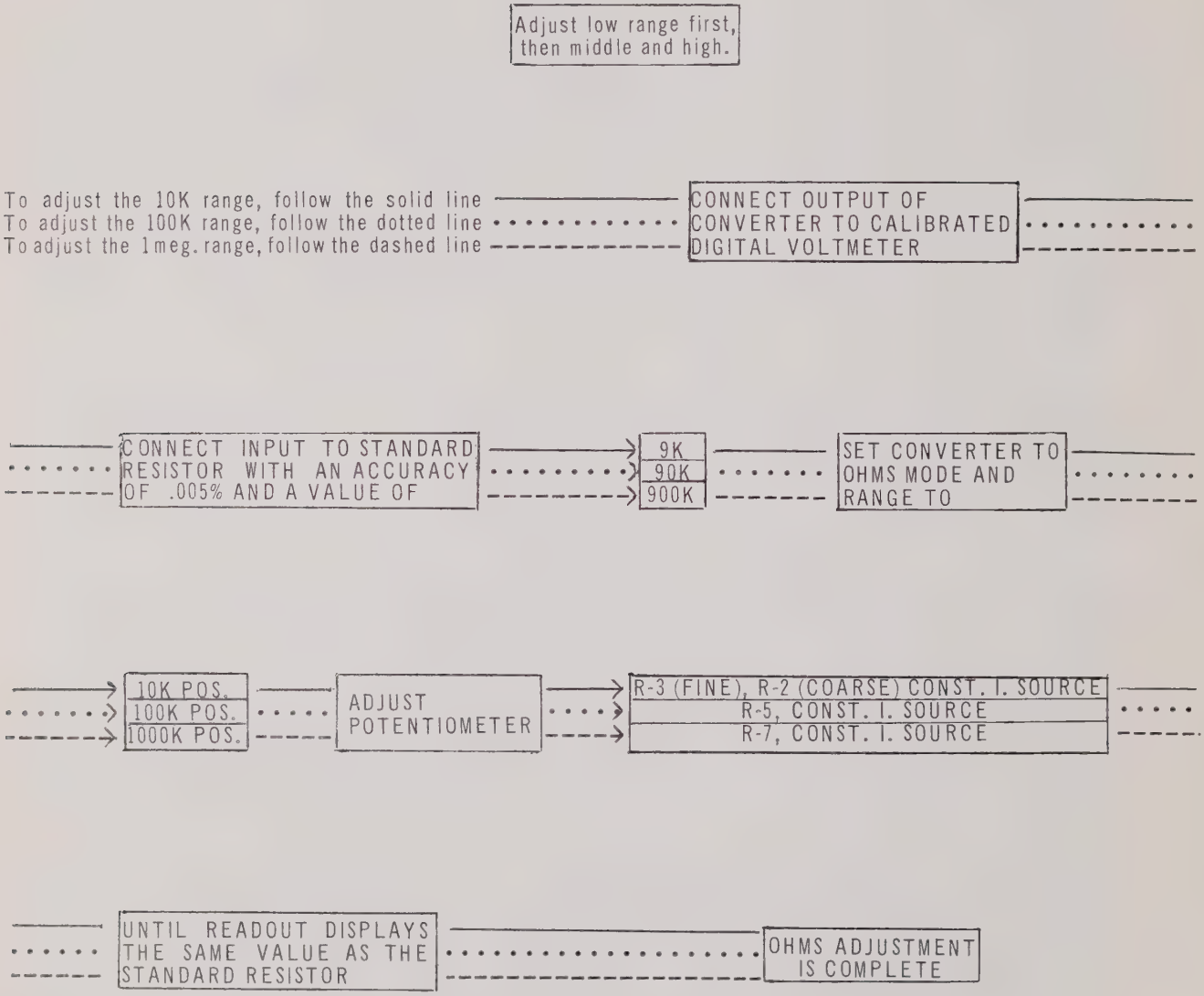
1104
1106
1108

Figure 4-3. Assembly layouts of the 1100 Series Converters.

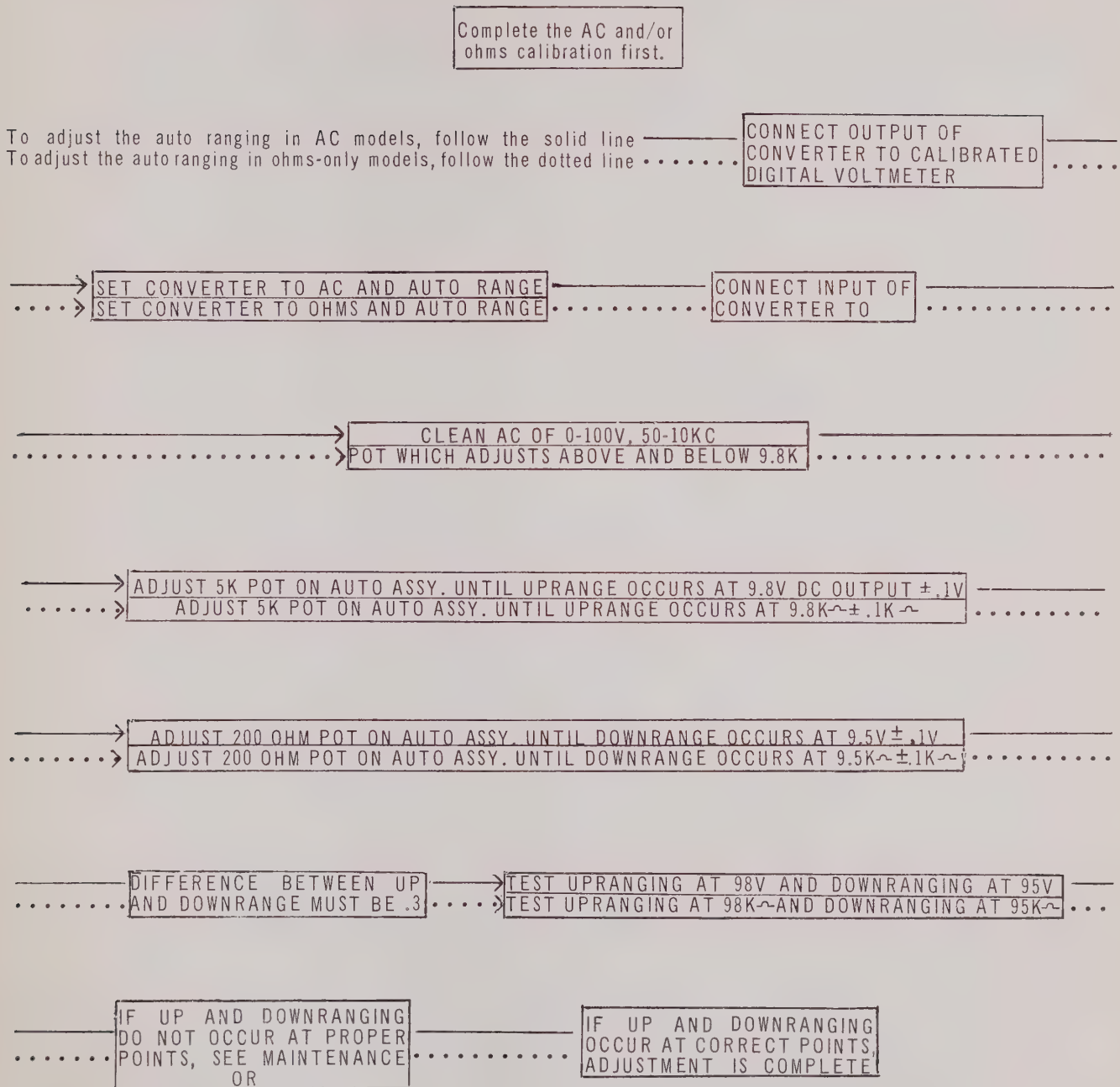
AC CALIBRATION CHART


Adjust low range first, then middle and high.
To adjust the 10V range, follow the solid line
To adjust the 100V range, follow the dotted line
To adjust the 1000V range, follow the dashed line
CONNECT OUTPUT OF CONVERTER TO CALIBRATED DIGITAL VOLTMETER
CONNECT INPUT OF CONVERTER TO STANDARD AC VOLTAGE KNOWN TO AN ACCURACY OF .01%
SET STANDARD VOLTAGE AT
9.5V 100CPS
95V 100CPS
950V 100CPS
SET CONVERTER TO AC MODE AND SET RANGE TO
10V
100V
1000V
ADJUST POTENTIOMETER
R-12, AC ATTEN.BD.
R-8, AC ATTEN.BD.
R-10, AC ATTEN.BD.
UNTIL READOUT IS THE SAME AS THE SOURCE VOLTAGE. IGNORE DECIMAL
CHANGE SOURCE FREQUENCY TO 10KC, ALL RANGES
ADJUST TRIM CAPACITOR
C-7, AC CONV. BD.
C-2, AC ATTEN. BD.
C-3, AC ATTEN. BD.
CAUTION HIGH VOLTAGE!
UNTIL READOUT IS THE SAME AS THE SOURCE VOLTAGE. IGNORE DECIMAL
SINCE THERE IS INTERACTION BETWEEN THE LOW AND HIGH FREQUENCY, THE PRECEDING STEPS ARE TO BE REPEATED FOR CORRECT 100CPS & 10KC.
IF ADJUSTMENT IS BEYOND RANGE OF POT, JUMPER OUT 500 OHM RESISTOR
R-11, AC ATTEN. BD.
R-7, AC ATTEN. BD.
R-9, AC ATTEN. BD.
CHECK INSTRUMENT ACCURACY AT 50, 400, 1000, & 4000CPS. ADJUST FOR BEST ACCURACY FROM 50 TO 10,000CPS
AC ADJUSTMENT COMPLETE

OHMS CALIBRATION CHART


Adjust low range first, then middle and high.
To adjust the 10K range, follow the solid line
To adjust the 100K range, follow the dotted line
To adjust the 1meg. range, follow the dashed line
CONNECT OUTPUT OF CONVERTER TO CALIBRATED DIGITAL VOLTMETER
CONNECT INPUT TO STANDARD RESISTOR WITH AN ACCURACY OF .005% AND A VALUE OF
9K
90K
900K
SET CONVERTER TO OHMS MODE AND RANGE TO
10K POS.
100K POS.
1000K POS.
ADJUST POTENTIOMETER
R-3 (FINE), R-2 (COARSE) CONST. I. SOURCE
R-5, CONST. I. SOURCE
R-7, CONST. I. SOURCE
UNTIL READOUT DISPLAYS THE SAME VALUE AS THE STANDARD RESISTOR
OHMS ADJUSTMENT IS COMPLETE

AUTO RANGE
ADJUSTMENT CHART


Complete the AC and/or ohms calibration first.
To adjust the auto ranging in AC models, follow the solid line
To adjust the auto ranging in ohms-only models, follow the dotted line
CONNECT OUTPUT OF CONVERTER TO CALIBRATED DIGITAL VOLTMETER
SET CONVERTER TO AC AND AUTO RANGE
SET CONVERTER TO OHMS AND AUTO RANGE
CONNECT INPUT OF CONVERTER TO
CLEAN AC OF 0-100V, 50-10KC POT WHICH ADJUSTS ABOVE AND BELOW 9.8K
ADJUST 5K POT ON AUTO ASSY. UNTIL UPRANGE OCCURS AT 9.8V DC OUTPUT ±.1V
ADJUST 5K POT ON AUTO ASSY. UNTIL UPRANGE OCCURS AT 9.8K~±.1K~
ADJUST 200 OHM POT ON AUTO ASSY. UNTIL DOWNRANGE OCCURS AT 9.5V±.1V
ADJUST 200 OHM POT ON AUTO ASSY. UNTIL DOWNRANGE OCCURS AT 9.5K~±.1K~
DIFFERENCE BETWEEN UP AND DOWNRANGE MUST BE .3
TEST UPRANGING AT 98V AND DOWNRANGING AT 95V
TEST UPRANGING AT 98K~AND DOWNRANGING AT 95K~
IF UP AND DOWNRANGING DO NOT OCCUR AT PROPER POINTS, SEE MAINTENANCE OR
IF UP AND DOWNRANGING OCCUR AT CORRECT POINTS, ADJUSTMENT IS COMPLETE

INITIAL CHECKS AND ADJUSTMENTS

To make initial checks and adjustments, follow this line.

ALLOW 30 MIN WARMUP

CONNECT CONVERTER OUTPUT TO 5-DIGIT DVM. SHORT INPUT, SET AT 1000V RANGE AND AC (OR OHMS ON OHMS-ONLY MODELS)

ADJUST OUTPUT TO ZERO WITH POT R-30 ON CONVERTER ASSEMBLY, OHMS

IF RANGE OF R-30 IS MORE POSITIVE THAN ZERO, CHANGE R-29 FROM 470K TO 1 MEGOHM.

IF RANGE OF R-30 IS MORE NEGATIVE THAN ZERO, CHANGE Q-13 TO ONE WITH A BETA OF 70 OR MORE

CONNECT SCOPE WITH 1MV OR BETTER SENSITIVITY TO OUTPUT OF THE CONVERTER

ADJUST R-13 AND R-25 ON MOD/DEMOD ASSEMBLY FOR MINIMUM NOISE AND SPIKE

USING PIN 6, AUX. PWR. SUPPLY AS GROUND, CHECK VOLTAGE WITH SCOPE ON THE FOLLOWING PINS

AUXILIARY POWER SUPPLY PIN	READ VOLTS	MAX. NOISE	+,– MUST MATCH TO WITHIN
4	+24 ±2V	1 MV	.7V
5	−24 ±2V	1 MV	.7V
7*	+10.8 → +12.0	200uv	.5V
8	−11.0 → −12.2	200uv	.5V
CONSTANT I SOURCE			
7	+14.25 → +15.75	200uv	.5V
8	−14.05 → −15.55	200uv	.5V

*Converters which measure AC only

ON AC CONVERTER MODELS, CONNECT DVM AT

- C-2(COM.) & TOP LEAD OF C-9, AC CONV.
- C-2(COM.) & BOTTOM LEAD OF R-19 AC CONV.
- C-2(COM.) & BOTTOM LEAD OF R-23 AC CONV.

ADJUST R-3 UNTIL DVM READS 6V ±.1V

ADJUST R-16 AND ALTERNATELY CHECK R-19 & R-23 UNTIL VOLTAGES AT THESE POINTS ARE MATCHED TO .01V

INTERACTION BETWEEN ADJUSTMENTS REQUIRES EARLIER SETTING RECHECK

CONNECT SCOPE & DVM TO OUTPUT OF CONVERTER

CONTINUE ON NEXT PAGE

ROUTINE INSPECTION AND CLEANING

All parts, surfaces, and threads should be inspected for damage, excessive wear, and corrosion. Loose screws should be tightened and individual components should be inspected for evidence of vibration or other damage.

Accumulations of dirt, grease, and extraneous matter found during visual inspections may be removed as follows:

Moisten a clean, lint-free cloth with cleaning solvent (Federal Specification P-D-661) and wipe clean all accessible parts. Less accessible accumulations of dirt or other foreign material may be removed with a clean, soft-bristled brush moistened in cleaning solvent, or with light air pressure below 15 psi. If solvent is used, be certain to work in a well-ventilated area and avoid prolonged inhalation of fumes. Solvent should be used away from heat and open flame.

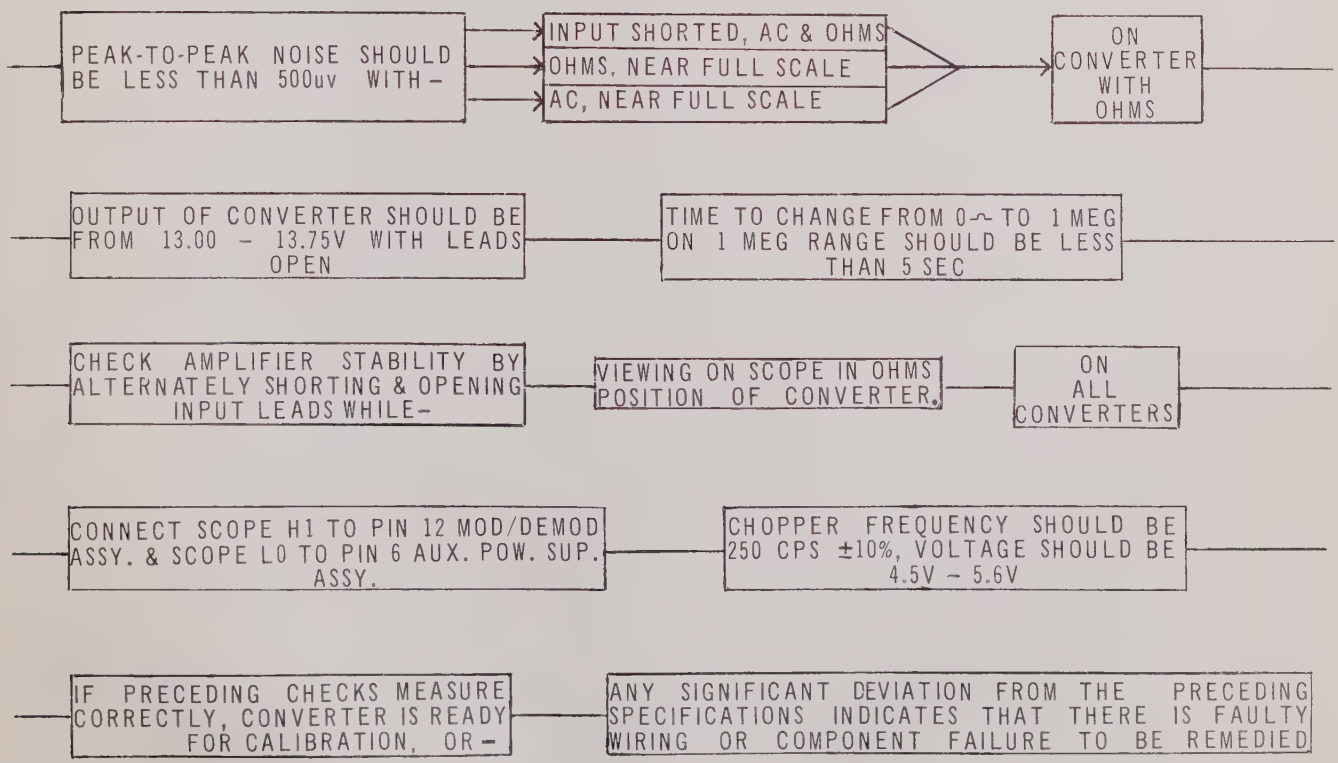
Rust, corrosion, minor nicks and scratches may be treated by polishing with crocus cloth (Federal Specification P-C-458 for ferrous metals; P-C-451 for aluminum). Clean all reworked parts with solvent and dry thoroughly.

When required, the surface of the front panel may be restored by touching it up with light grey enamel (Military Specification MIL-E-15090B, Type 3, Class 1) using standard shop methods.

ELECTRICAL CHECKS AND ADJUSTMENTS

In order to properly check and adjust an 1100-type converter, a five-digit digital voltmeter in good calibration is needed. Figures 4-1 and 4-2 show the physical location of adjustment points. Figure 4-3 shows the physical position of assemblies in the 1100 models. Consult these figures as well as the appropriate schematic drawings at the end of the manual when working with the Initial Checks and Adjustments Chart.

INITIAL CHECKS AND ADJUSTMENTS (Continued)


PEAK-TO-PEAK NOISE SHOULD BE LESS THAN 500uv WITH –
INPUT SHORTED, AC & OHMS
OHMS, NEAR FULL SCALE
AC, NEAR FULL SCALE
ON CONVERTER WITH OHMS
OUTPUT OF CONVERTER SHOULD BE FROM 13.00 – 13.75V WITH LEADS OPEN
TIME TO CHANGE FROM 0–~ TO 1 MEG ON 1 MEG RANGE SHOULD BE LESS THAN 5 SEC
CHECK AMPLIFIER STABILITY BY ALTERNATELY SHORTING & OPENING INPUT LEADS WHILE–
VIEWING ON SCOPE IN OHMS POSITION OF CONVERTER.
ON ALL CONVERTERS
CONNECT SCOPE H1 TO PIN 12 MOD/DEMOD ASSY. & SCOPE L0 TO PIN 6 AUX. POW. SUP. ASSY.
CHOPPER FREQUENCY SHOULD BE 250 CPS ±10%, VOLTAGE SHOULD BE 4.5V – 5.6V
IF PRECEDING CHECKS MEASURE CORRECTLY, CONVERTER IS READY FOR CALIBRATION, OR –
ANY SIGNIFICANT DEVIATION FROM THE PRECEDING SPECIFICATIONS INDICATES THAT THERE IS FAULTY WIRING OR COMPONENT FAILURE TO BE REMEDIED

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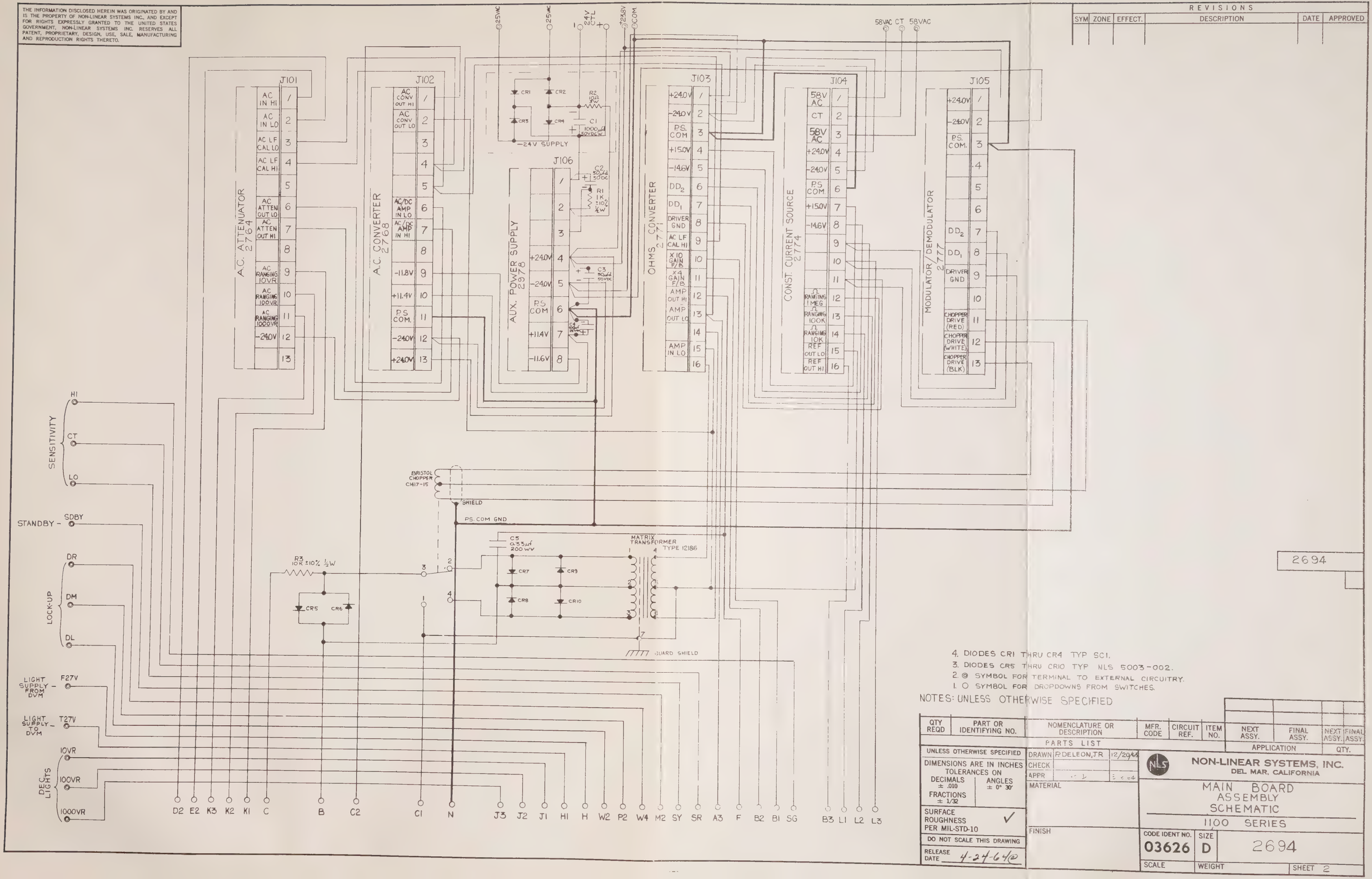
REVISIONS					
SYM	ZONE	EFFECT.	DESCRIPTION	DATE	APPROVED



2694

4. DIODES CR1 THRU CR4 TYP SC1.
3. DIODES CR5 THRU CR10 TYP NLS 5003-002.
2. @ SYMBOL FOR TERMINAL TO EXTERNAL CIRCUITRY.
1. O SYMBOL FOR DROPDOWNS FROM SWITCHES.

NOTES: UNLESS OTHERWISE SPECIFIED

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.	NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
		PARTS LIST				APPLICATION		QTY.	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010 ANGLES ± 0° 30'
FRACTIONS ± 1/32
SURFACE ROUGHNESS PER MIL-STD-10 ✓
DO NOT SCALE THIS DRAWING
RELEASE DATE 4-27-64

DRAWN P. DELEON, JR 12/20/63
CHECK
APPR
MATERIAL
FINISH

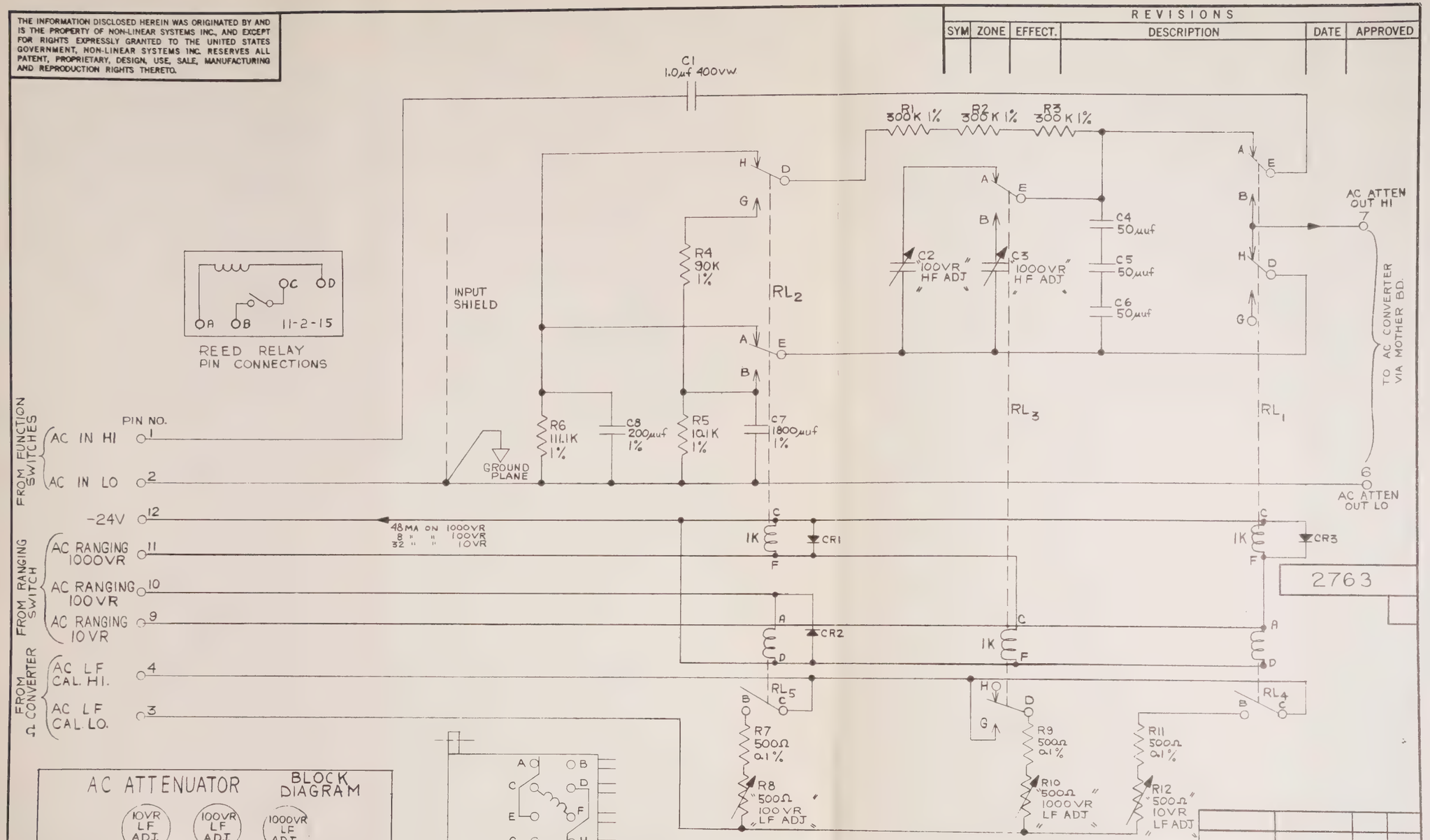
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

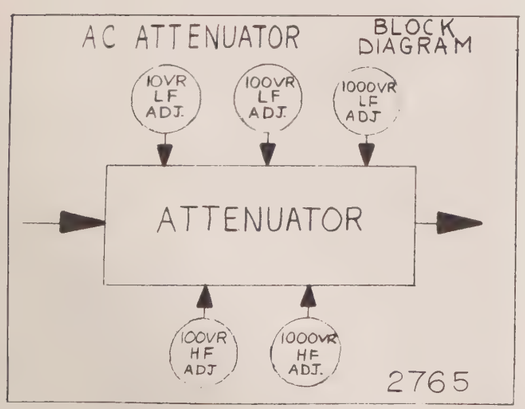
MAIN BOARD ASSEMBLY SCHEMATIC
1100 SERIES

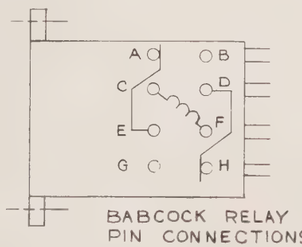
CODE IDENT NO.	SIZE	
03626	D	2694
SCALE	WEIGHT	SHEET 2

THE INFORMATION DISCLOSED HEREIN WAS ORIGINATED BY AND IS THE PROPERTY OF NON-LINEAR SYSTEMS INC., AND EXCEPT FOR RIGHTS EXPRESSLY GRANTED TO THE UNITED STATES GOVERNMENT, NON-LINEAR SYSTEMS INC. RESERVES ALL PATENT, PROPRIETARY, DESIGN, USE, SALE, MANUFACTURING AND REPRODUCTION RIGHTS THERETO.

REVISIONS					
SYM	ZONE	EFFECT.	DESCRIPTION	DATE	APPROVED







3. RELAYS RL_4 & RL_5 - REED NLS 11-2-15
2. RELAYS RL_1, RL_2 & RL_3 BABCOCK BR7Y-1KC7
1. ALL DIODES NLS 5003-002

NOTE: UNLESS OTHERWISE SPECIFIED.

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.	NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
PARTS LIST						APPLICATION		QTY.	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010 | ANGLES ± 0° 30'
FRACTIONS ± 1/32
SURFACE ROUGHNESS PER MIL-STD-10 ✓
DO NOT SCALE THIS DRAWING
RELEASE DATE 3-19-64

DRAWN	P. DELEON, JR.	11/23/63
CHECK		
APPR		

MATERIAL —
FINISH —

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC-
AC ATTENUATOR
SERIES 1100 (CONV.)

CODE IDENT NO.	SIZE	
03626	C	2763
SCALE	WEIGHT	SHEET 2

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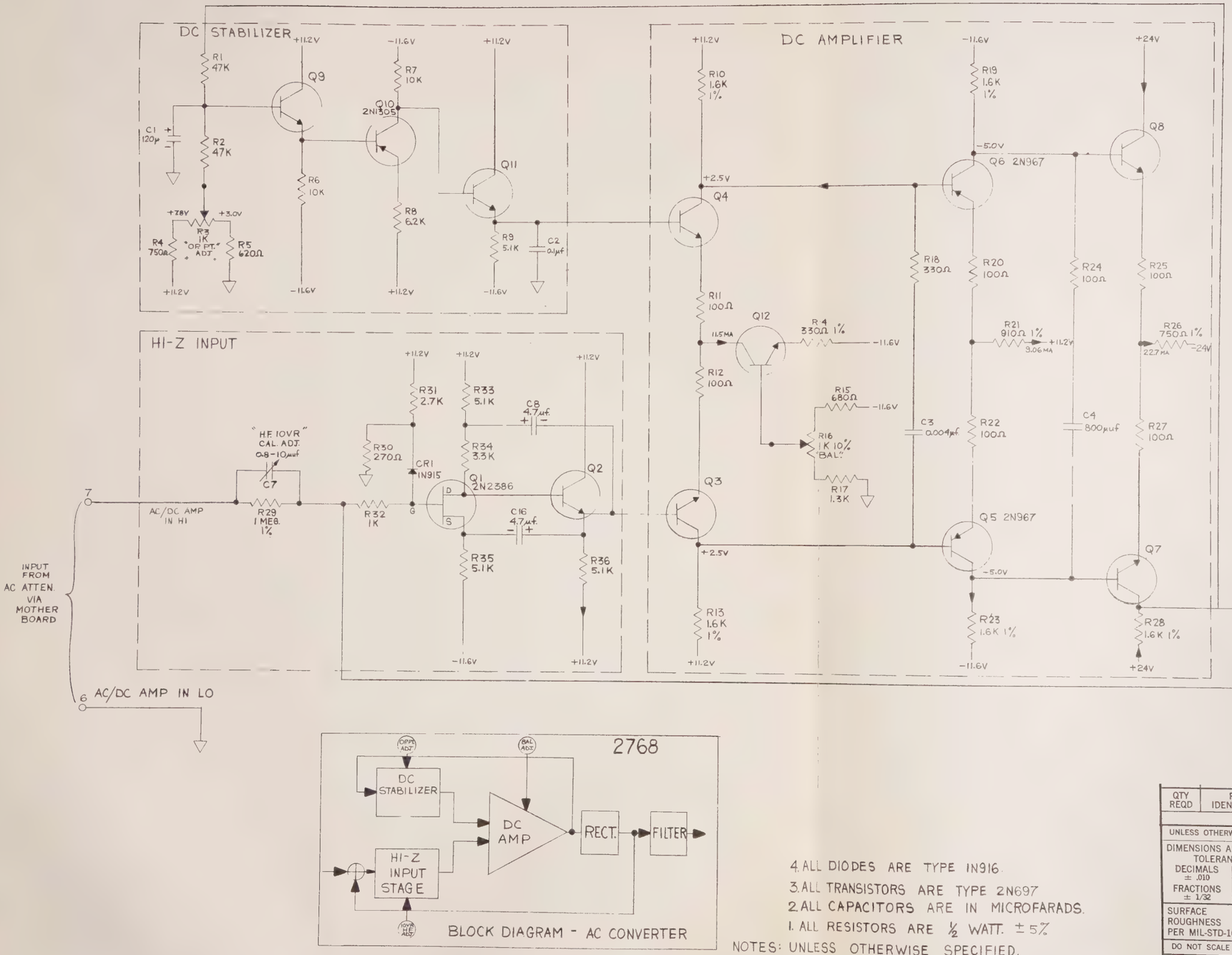
REVISIONS					
SYM	ZONE	EFFECT.	DESCRIPTION	DATE	APPROVED



NOTES: UNLESS OTHERWISE SPECIFIED.
1. ALL RESISTORS ARE ½ WATT. ±5%
2. ALL CAPACITORS ARE IN MICROFARADS.
3. ALL TRANSISTORS ARE TYPE 2N697
4. ALL DIODES ARE TYPE IN916.

2766

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.	NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY
		PARTS LIST				APPLICATION		QTY.	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010
ANGLES ± 0° 30'
FRACTIONS ± 1/32
SURFACE ROUGHNESS PER MIL-STD-10 ✓
DO NOT SCALE THIS DRAWING
RELEASE DATE 4-2-64

DRAWN DELEON, JR. 11/23/63
CHECK
APPR 3/2/64
MATERIAL
FINISH

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC – AC CONVERTER

SERIES 1100

CODE IDENT NO.	SIZE	
03626	D	2766
SCALE	WEIGHT	SHEET 2

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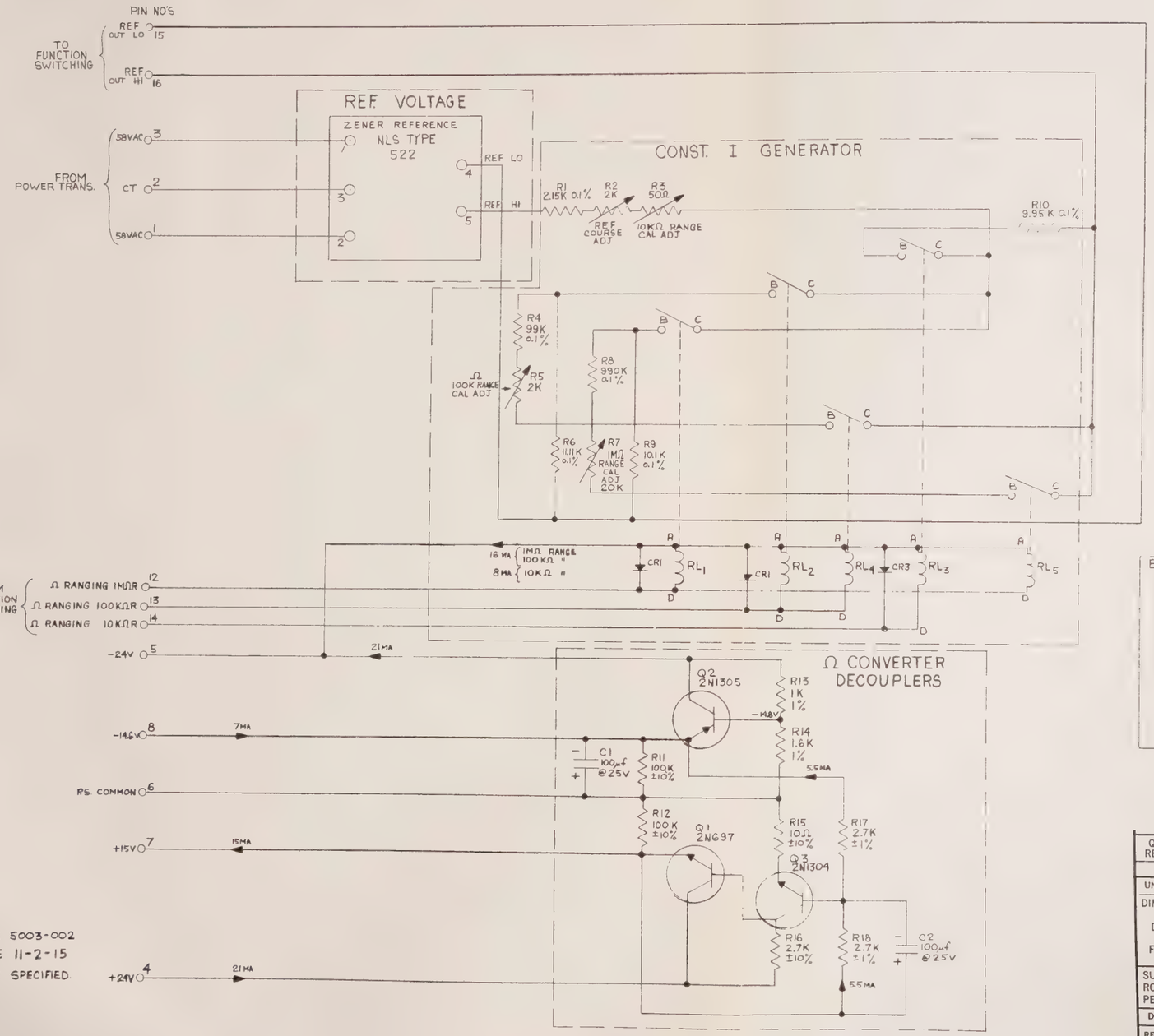
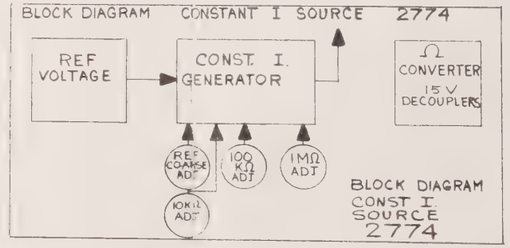
REVISIONS					
SYM	ZONE	EFFECT.	DESCRIPTION	DATE	APPROVED



3.
2. DIODES NLS TYPE 5003-002
1. RELAYS NLS TYPE 11-2-15
NOTE: UNLESS OTHERWISE SPECIFIED.

REED RELAY PIN CONNECTIONS



2772

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.	NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
		PARTS LIST				APPLICATION		QTY.	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010 ANGLES ± 0° 30'
FRACTIONS ± 1/32
SURFACE ROUGHNESS PER MIL-STD-10 ✓
DO NOT SCALE THIS DRAWING
RELEASE DATE 4-2-64

DRAWN	P. DELEON, JR.	11/26/63
CHECK		
APPR	I. Hoop.	3/19/64

MATERIAL
FINISH

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC - CONST. I. SOURCE
SERIES 1100 (CONV.)

CODE IDENT NO.	SIZE	
03626	D	2772
SCALE	WEIGHT	SHEET 2

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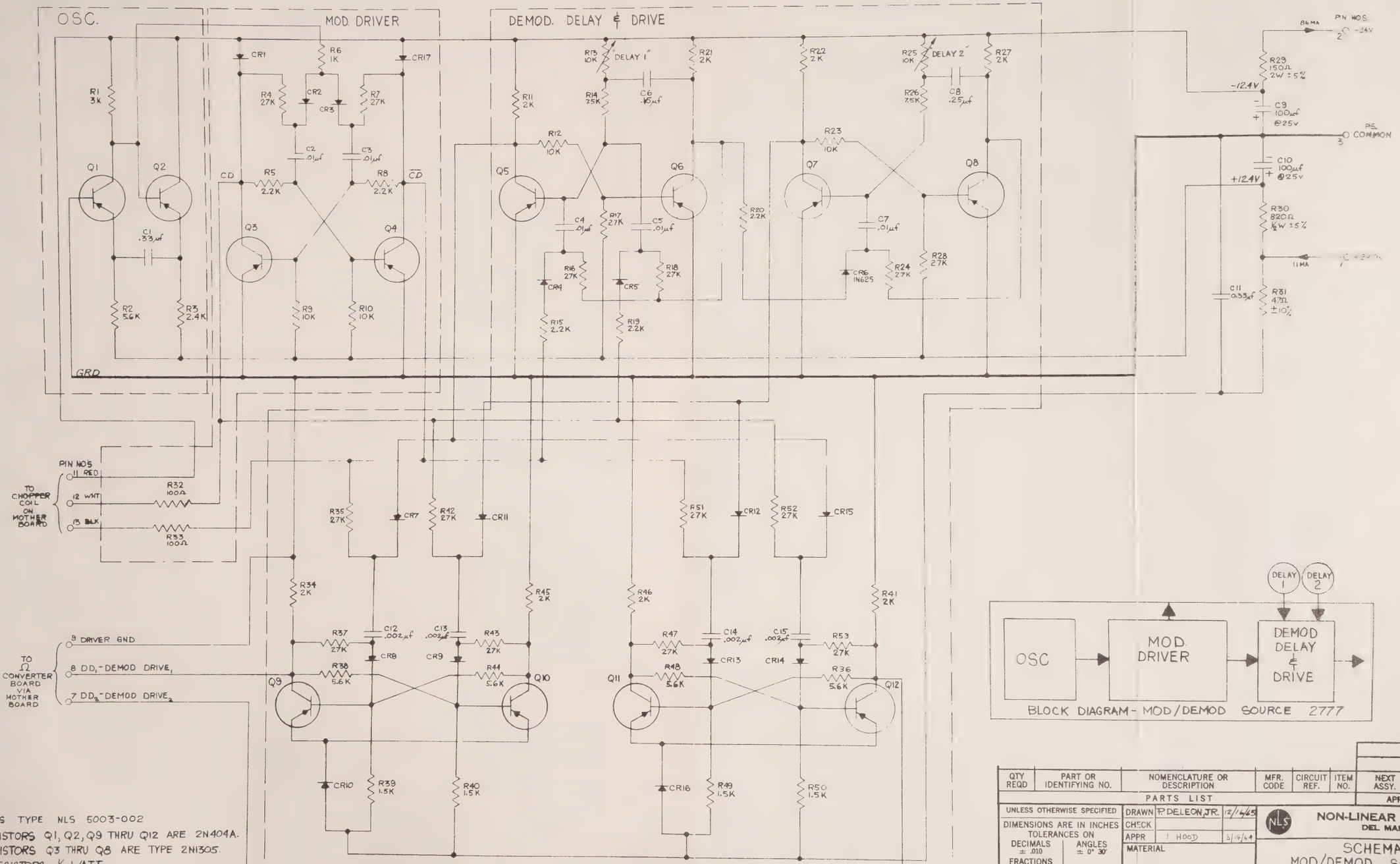
REVISIONS					
SYM	ZONE	EFFECT.	DESCRIPTION	DATE	APPROVED



4. DIODES TYPE NLS 5003-002
3 TRANSISTORS Q1, Q2, Q9 THRU Q12 ARE 2N404A.
2 TRANSISTORS Q3 THRU Q8 ARE TYPE 2N1305.
1 ALL RESISTORS ½ WATT.

NOTES: UNLESS OTHERWISE SPECIFIED

BLOCK DIAGRAM - MOD/DEMOD SOURCE 2777

2777

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.	NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
		PARTS LIST				APPLICATION		QTY.	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010
ANGLES ± 0° 30'
FRACTIONS ± 1/32
SURFACE ROUGHNESS PER MIL-STD-10 ✓
DO NOT SCALE THIS DRAWING
RELEASE DATE

DRAWN P. DELEON, JR. 12/1/63
CHECK
APPR I. HOOD 3/19/64
MATERIAL
FINISH

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC - MOD/DEMOD SOURCE
SERIES 1100

CODE IDENT NO. 03626 | SIZE D | 2777
SCALE | WEIGHT | SHEET 2

-24V REGULATOR

AC CONVERTER ±12V DECOUPLERS

BLOCK DIAGRAM- AUX. POWER SUPPLY-2978

Q1 2N1540

R1 100Ω ±10%

R14 2.2K ±10%

Q2 2N1305

Q3 2N1305

8.9 MA

C2 50µf 50VW

R4 2.7Ω 1%

FROM -24V UNREGULATED POWER SUPPLY ON MAIN BOARD

2

3

1

PIN NO'S

C1 0.0047µf

R2 10K ±10%

R3 10Ω ±10%

R5 2.7K 1%

ADD THIS ONLY WHEN INPUT CONVERTER USED IN 4900 SERIES.

PIN NO'S

P.S. COM. 6

50uf @ 50VW

+24V 4

-24V 5

-24V REGULATOR

53MA

R6 1.6K ±1%

+11.8V

6.5MA

R7 1.8K ±1%

R13 150Ω ±10%

Q4 2N697

1MA

C3 100µf 25VW

R10 2.2K ±10%

5MA

2N1305 Q5

R11 150Ω ±10%

Q6 2N1183

42MA

R12 10Ω ±10%

+11.2V 7

39MA

7MA

R8 1.6K ±1%

R9 1.6K ±1%

C4 100µf 25VW

-11.6V 8

AC CONVERTER ±12V DECOUPLERS

35MA

1. RESISTORS ½ WATT.

NOTE: UNLESS OTHERWISE SPECIFIED.

DRWN. BY: P. DELEON JR. 12/17/63

SCHEMATIC- 1100
AUX. PWR. SUPPLY
2980 SHT. 2

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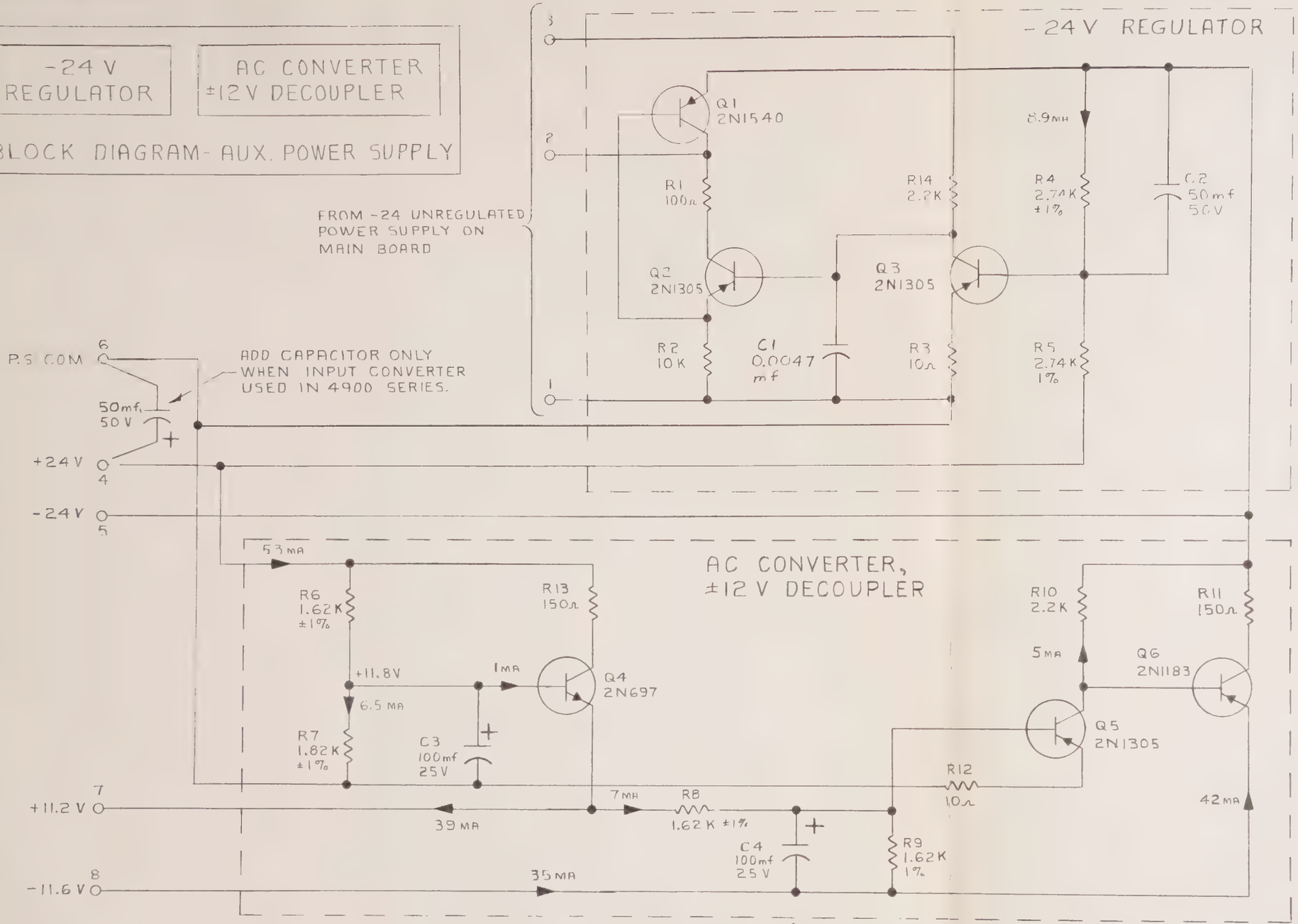
REVISIONS					
SYM	ZONE	EFFECT.	DESCRIPTION	DATE	APPROVED

-24 V REGULATOR

AC CONVERTER ±12 V DECOUPLER

BLOCK DIAGRAM- AUX. POWER SUPPLY



2980

0

NOTES: UNLESS OTHERWISE SPECIFIED.

1. RESISTORS ½ WATT, 10%

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.
PARTS LIST					

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION		QTY.	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010
ANGLES ± 0° 30'
FRACTIONS ± 1/32
SURFACE ROUGHNESS PER MIL-STD-10 ✓
DO NOT SCALE THIS DRAWING
RELEASE DATE 6-8-64

DRAWN	DE COURT	6-6-64
CHECK	L.E. SHADT	6-6-64
APPR	L.E. SHADT	6-6-64

MATERIAL —

FINISH —

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC
AUX - POWER SUPPLY
SERIES 1100

CODE IDENT NO.	SIZE	
03626	C	2980
SCALE —	WEIGHT —	SHEET 2 of 2

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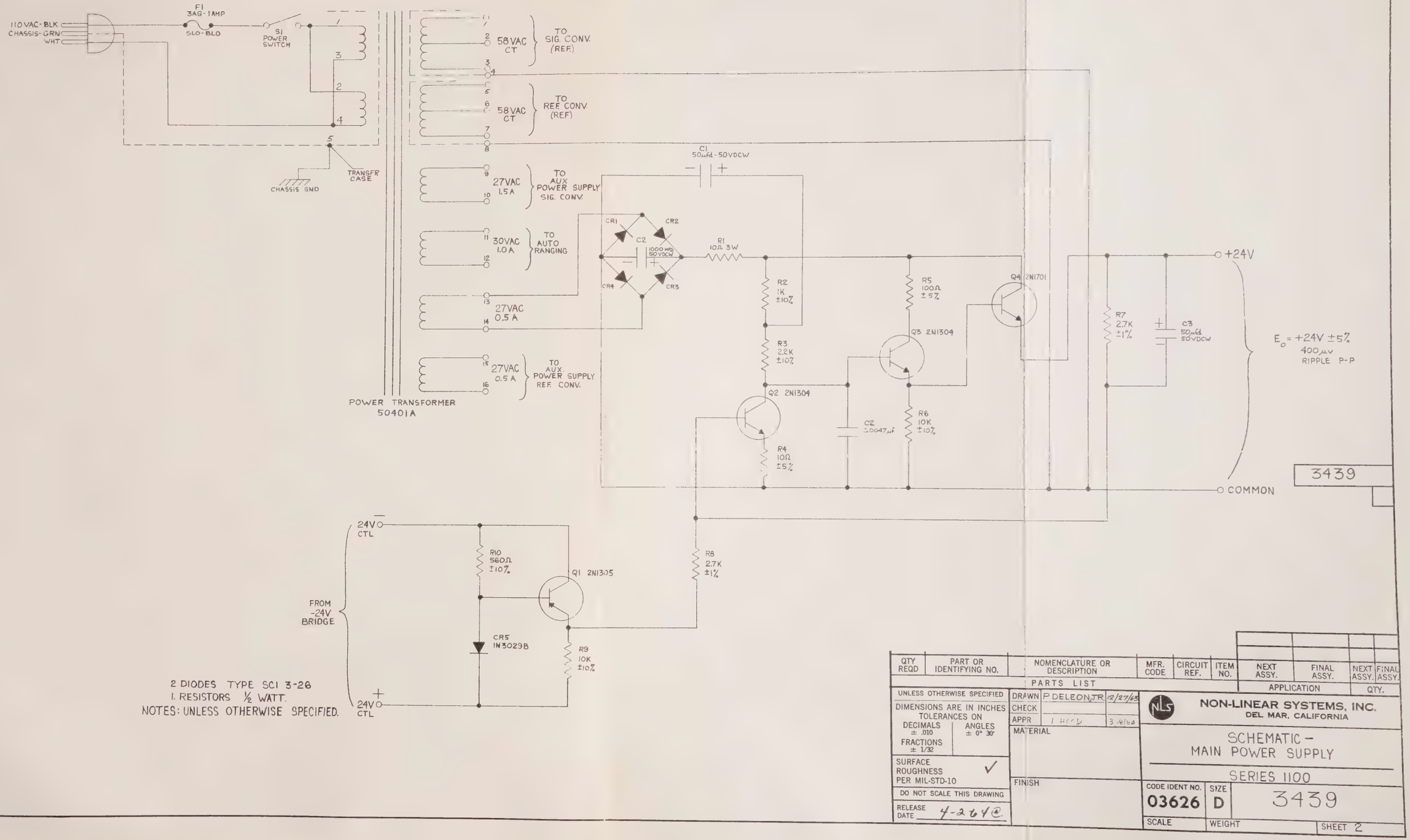
REVISIONS					
SYM	ZONE	EFFECT.	DESCRIPTION	DATE	APPROVED



2 DIODES TYPE SCI 3-26
1. RESISTORS ½ WATT.
NOTES: UNLESS OTHERWISE SPECIFIED.

3439

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.	NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
		PARTS LIST				APPLICATION		QTY.	

UNLESS OTHERWISE SPECIFIED	DRAWN	P DELEON JR 12/27/65
DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS ± .010 ANGLES ± 0° 30' FRACTIONS ± 1/32	CHECK	
	APPR	3.6.66
SURFACE ROUGHNESS PER MIL-STD-10 ✓	MATERIAL	
DO NOT SCALE THIS DRAWING	FINISH	
RELEASE DATE 4-26-66		

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC – MAIN POWER SUPPLY

SERIES 1100

CODE IDENT NO.	SIZE	
03626	D	3439

SCALE | WEIGHT | SHEET 2

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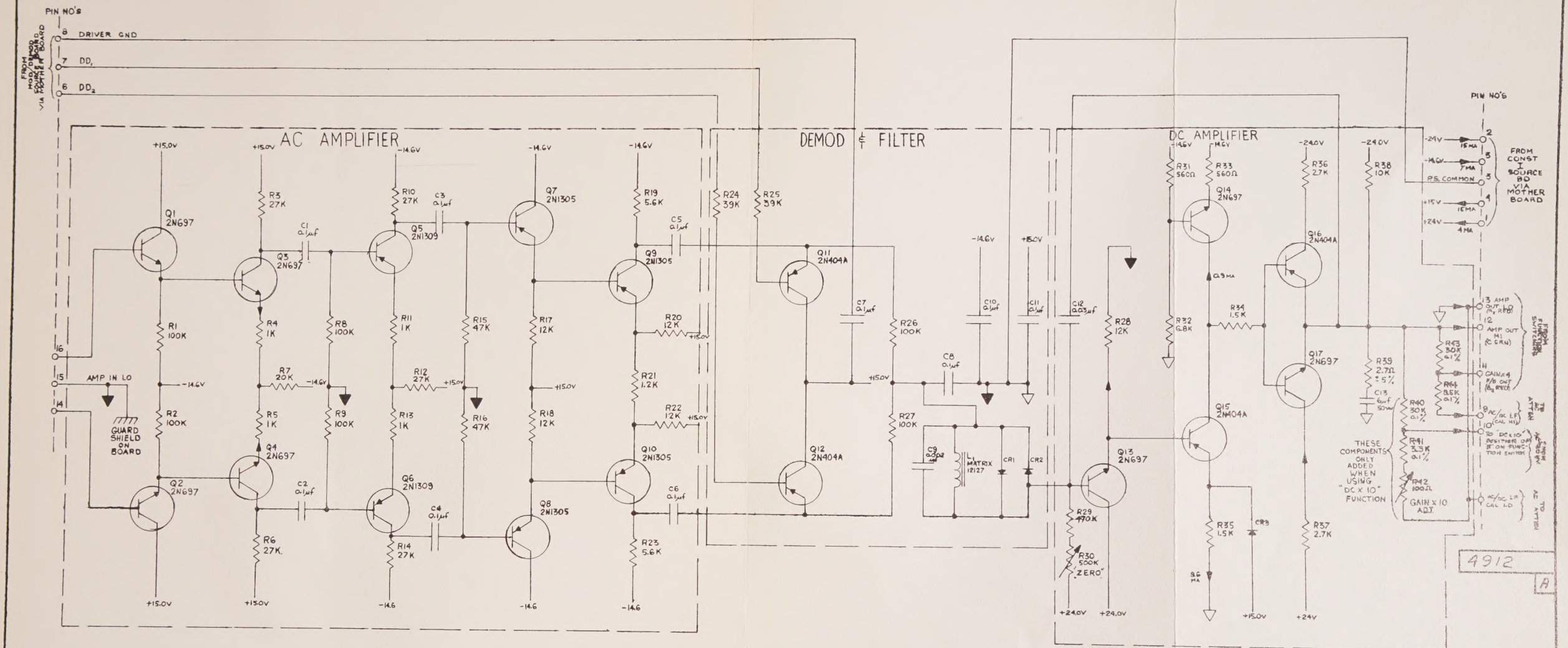
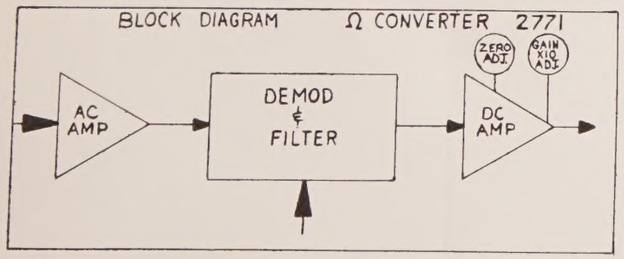
REVISIONS					
SYM	ZONE	EFFECT.	DESCRIPTION	DATE	APPROVED



BLOCK DIAGRAM Ω CONVERTER 2771



4. CAPACITOR WORKING VOLTAGES (100V)
3. ALL DIODES NLS 5003-002
2. ALL RESISTORS ½ WATT
1. ALL RESISTORS 10%

NOTES: UNLESS OTHERWISE SPECIFIED

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.	NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY
		PARTS LIST				APPLICATION		QTY.	

UNLESS OTHERWISE SPECIFIED	DRAWN	P. DELEON, JR	11/26/63
DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS ± .010 FRACTIONS ± 1/32 ANGLES ± 0° 30'	CHECK		
	APPR		
SURFACE ROUGHNESS PER MIL-STD-10 ✓	MATERIAL		
DO NOT SCALE THIS DRAWING	FINISH		
RELEASE DATE			

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC-
OHMS CONVERTER
SERIES 1100

CODE IDENT NO.	SIZE	
03626	D	4912
SCALE	WEIGHT	SHEET 2

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DEL MAR, CALIFORNIA